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S-50 PLANT: HISTORICAL, ECONOMIC, AND PRODUCTION DATA (U)

RHTG # 40,969

BOX # 1045

1. Historical Background.

a. Purpose. - The original purpose of the S-50 Project

was to supply feed with above-normal concentration of Uranium-235 to Y-12, until such time as K-25 could get into large scale production. Starting in June, 1945, S-50 product was fed to K-25 instead of Y-12.

The Liquid Thermal Diffusion Plant utilized as feed refined uranium hexafluoride obtained from the Marshaw Chemical Company, and containing the isotopes of uranium in their naturally occurring proportions.

It was operated so as to increase the isotopic concentration of U-236 from 0.71 to 0.85 mol per cent, and produced a tails product with concentration of 0.67 mol per cent. The plant was shut down in September, 1945.

b. Research. - The prosecution of the S-50 Project did not require that the Manhattan District institute a thermal diffusion research program. The S-50 Plant is based upon operating principles and process equipment designs which had been worked out by the Naval Research Laboratory.

c. Construction. - The H. K. Ferguson Company acted as Architect-Engineer-Manager under contract W-7409-eng-23. Clearing of the site was begun on July 9, 1944, and preliminary operations started on September 16, 1944. Since the available steam supply from the K-25 Power House was to be greatly reduced as operation of the K-25 process

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plant was begun, the construction of the S-50 Boiler Plant was authorized by the District Engineer on February 15, 1945. The Ferguson Company acted as Architect-Engineer for this work under contract W-22-075-eng-58. Construction of the boiler plant was managed by the J. A. Jones Construction Company under Modification No. 6 of contract W-7421-eng-11.

d. Operation. - S-50 operation was the responsibility of the Ferroleve Corporation, a totally-owned Ferguson subsidiary, under contract W-7409-eng-100.

e. Success of Operation. - The S-50 production record, as tabulated below (for the most representative period), shows an increasing trend toward the theoretical rate originally predicted on the basis of 100 grams of UF₆ per column per day. Production during June, 1945, the last month of full scale operation, amounted to 90 per cent of theoretical.

<u>Month</u>	<u>Ferroleve Cost</u>	<u>K-25 Steam and Electricity Cost</u>	<u>Total Cost</u>	<u>Production (Lbs. UF₆)</u>	<u>Unit Cost (\$/Lb. UF₆)</u>
January	\$300,000	\$165,000	\$ 465,000	840.9	553
February	435,000	261,000	696,000	3158.0	220
March	493,000	291,000	784,000	6004.4	130
April	743,000	395,000	1,138,000	9083.8	125
May	450,000	290,000	740,000	9299.4	80
June	406,000	338,000	744,000	12730.1	58

This table is taken from the Manhattan District History, Book VI - "Liquid Thermal Diffusion Project", p. 5.29.

f. Steam Supply. - The bulk of the steam requirements for

S-50 plant operation were supplied by the K-25 Power Plant at the rate of approximately 80,000 pounds per hour per rack, at 1250 p.s.i. and 925°F. There are 21 racks in the S-50 plant. Based upon assumptions described in a report prepared by the Carbide and Carbon Chemicals Corporation dated October 30, 1946, title: "Combined Operation of S-50, K-27, and K-25 Plants at 412500% Product Purity", the figure of 750,000 pounds per hour is calculated for steam currently available from the K-25 Power House for S-50 plant operation. This would be sufficient for operation of nine racks, but applies for only seven months (not consecutive) out of the year. It is further assumed that the S-50 steam plant can supply seven additional racks for twelve months in the year.

2. Economy of Operation. - It is considered possible, but not economically sound, to place the S-50 Plant back into operation. Previous S-50 operating costs are shown in Paragraph 1e, above. A recent theoretical study, (summarized in the report mentioned in Paragraph 1f, above) predicts that operation of S-50 (to the extent possible under present circumstances of steam availability) could increase the overall production rate of K-25 and K-27 by approximately 2%. This is considered equivalent to the installation of 32 additional stages in K-27. Recommendation against operating the S-50 Plant is based upon the following cost considerations:

a. S-50 Operation vs. Additional Stage Installation. - The Kellex Field Progress report of March 31, 1946 estimates the total cost

of the K-27 cascade together with power distribution facilities (exclusive of auxiliary structures) at \$58,248,251. Distributing this cost uniformly among the 540 K-27 stages, and extending it to apply to hypothetical additional construction, a cost of \$3,451,748 is calculated for 32 additional stages, which are considered equivalent in production capacity to the S-50 plant. Taking the S-50 operating cost conservatively at \$600,000 per month, S-50 operating cost would exceed the construction cost of equivalent additional K-27 stages in less than six months. Operation of these additional stages would result in a negligible increase in total K-27 plant operation costs.

b. S-50 Operation vs. Increase in Feed Rate. - A Carbide theoretical report dated October 8, 1946, title "412500 Product at High Feed Rates" indicates that a 2% increase in production rate may also be obtained (without alteration of existing facilities) by increasing the present feed rate to K-25, K-27 (4200 lbs UF₆/day) by 10.8 per cent. Taking the cost of feed material as \$5.11 per pound of UF₆, this would mean that the 2% production increase could be obtained without expenditure for plant alteration, and with a monthly increase in feed cost of \$42,320, or 7% of S-50 plant operating costs. Under such conditions the waste rate from K-27 would increase by 10.8% (over either its present value, or the value with S-50 in operation) but would not change significantly in concentration of light component.

3. Economy of Maintenance. - During the calendar year 1946 the cost of maintaining the S-50 Plant and providing security protection

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F-25	Transfer Rack
F-26	Time Office
F-28	Time Office
F-29	Gasoline Filling Station
F-31	Inflammable Storage

It is estimated (Enclosure 2) that the total cost of dismantling the S-50 Plant as discussed above would be \$1,783,181, but that \$289,785 could be recovered in salvage value of equipment. It has also been estimated that the S-50 main process building could be converted to a warehouse in its present location at a total cost of \$718,680 with the recovery of \$172,508 in salvage equipment. If it is desired simply to remove as much salable material as possible without complete dismantling, an estimate has been prepared (Enclosure 2) indicating that the cost of this work would be \$57,175, and that the recovery of \$114,866 could be realized by disposal of salvagable material.

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